

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No. 17

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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Ex parte RICHARD L. ELLIOTT and GUY F. HUDSON

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Appeal No. 2000-0170  
Application No. 08/811,124

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ON BRIEF

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Before KRASS, BARRETT, and LALL, Administrative Patent Judges  
LALL, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the Examiner's final rejection of claims 41 to 60, all of the pending claims in the application.

According to appellants (brief at page 2), the invention is directed to plug or contact connections to metallization lines

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patterning of the metallization lines, and to resist electro-migration and creep failure between the plug or contact and the metallization line.

The following claims is illustrative of the invention:

41. A contact plug and metallization line structure comprising:

a semiconductor substrate having a contact surface thereon;

an insulation layer having a contact hole therethrough extending to the contact surface on the semiconductor substrate;

a plug substantially composed of a first metal and situated in said contact hole, said plug being electrically insulated by said insulation layer;

a metallization line substantially composed of a second metal, wherein said plug and said metallization line are electrically connected and have a substantially continuous composition gradient of a selected alloying element between said first metal and said second metal.

The examiner relies upon the following references:

Yoda et al. (Yoda)	5,254,872	Oct. 19, 1993
Lee et al. (Lee)	5,355,020	Oct. 11, 1994
Honeycutt et al. (Honeycutt)	5,644,166	Jul. 01, 1997
		(filed Jul. 17, 1995)

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Claim 42 stands rejected under 35 U.S.C. § 102 as being anticipated by Yoda.

Claim 42 also stands rejected under 35 U.S.C. § 103 as being unpatentable over Lee and Wilson.

Claims 43 and 44 stand rejected under 35 U.S.C. § 103 as being unpatentable over Lee and Honeycutt.

Claims 43 through 45, and 57 through 60 stand rejected under 35 U.S.C. § 103 as being unpatentable over Yoda in view of Honeycutt.

Claims 46 through 48, and 57 through 60 stand rejected under 35 U.S.C. § 103 as being unpatentable over Lee, Wilson and Honeycutt.

Rather than repeat the arguments of appellants and the examiner, we make reference to the amended brief (paper no. 13, filed on Feb. 22, 1999), reply brief (paper no. 15, filed on Jun. 28, 1999) and the examiner's answer (paper no. 14, mailed on April 22, 1999) for the respective details thereof.

OPINION

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Rejections under 35 U.S.C. § 102

A prior art reference anticipates the subject of a claim when the reference discloses every feature of the claimed invention, either explicitly or inherently. (See Hazani v. Int'l Trade Comm'n, 126 F.3d 1473, 1477, 44 USPQ2d 1358, 1361 (Fed. Cir. 1997) and RCA Corp. v. Applied Digital Data Sys., Inc., 730 F.2d 1440, 1444, 221 USPQ 385, 388 (Fed. Cir. 1984).

Lee

In accordance with the above guidelines, the examiner, to meet the recited limitation of "said plug and said metallization line are electrically connected and have a substantially continuous composition gradient of a selected alloy element between said first metal and said second metal" (claim 41), asserts (answer at page 4) that (in Lee):

because of the silicon diffusion from one metal layer to another metal layer during heat treatment, the diffusion equilibrium is inherently formed between the contacting surface of the first metal and the second metal. Therefore, the limitation of having a substantially continuous composition gradient of a selected alloy element between the first metal and the second metal is inherently met by Fig. 5 of Lee.

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layer with no Si component absorbs Si atoms from the metal with the Si component . . . .' The particulars . . . are entirely absent from the disclosure of Lee."

The examiner responds (answer at page 10) that

[in reference to Fig. 5 of Lee] the plug 25 and the metallization line 27 are electrically connected, and wherein the surface of the metallization line 27 is planarized by heat-treated in the same manner as first metal layer . . . . Accordingly, after heat treated, the first metal and the second metal react to each other, and the metal layer with no Si component absorbs Si atoms from the metal with the Si component to form a composite metal layer . . . . In other words, because of the silicon diffusion from one metal layer to another metal layer during heat treatment, the diffusional equilibrium is inherently formed between the contacting surface of the first metal and the second metal.

Appellants respond (reply brief at page 2) that

"[d]iffusional equilibrium requires two phases that are miscible and have fully intermingled. In other words, no composition gradient is possible. Anticipation is therefore not present [in Lee]."

After review of the two positions, we are of the view that because of the diffusion of Si atoms from one metal to the other

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atoms from one metal to the other in the equilibrium state. Therefore, we agree with the examiner that there will be the recited continuous composition gradient of Si atoms from one metal to the other metal. Our view is consistent with the disclosure in Lee, particularly column 6, lines 29 through 38 where it is clearly shown that a metal with no Si component absorbs Si atoms from the metal with the Si component as the planarization process takes place in Lee.

Therefore, we sustain the anticipation rejection of claims 41, 49 through 51 and 52 through 56 by Lee.

Yoda

In rejecting claims 41, 42, 49 through 51, and 52 through 56 as being anticipated by Yoda (answer at pages 4 and 5), the examiner asserts (id. at page 5):

[i]t is noted that after heat treated during a fabrication process, a continuous composition gradient of aluminum alloy is inherently formed between the boundary of the first metal 7a of AlSi and the second metal 8 of Al-Si-Cu because of the diffusion from one metal layer to the other metal layer. Therefore, this limitation ["said plug and said metallization line . . . have a substantially continuous composition

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Appellants argue (brief at page 4) that "Yoda is entirely silent regarding Figure 3G on how compositions are distributed and diffusional equilibrium, and the absence of a composition gradient must be assumed." The examiner responds (answer at page 11) that "[s]imilarly, with regard to Fig. 3G of Yoda, after heat-treated, a continuous composition gradient of aluminum alloy is inherently formed between the boundary of the first metal 7a of Al-Si and the second metal 8 of Al-Si-Cu." Appellants rebut (reply brief at page 2) that "Yoda, however, is entirely devoid of any heat treatment teaching after deposition of his Al-Si-Cu film. Therefore, anticipation is not established."

We, like appellants, do not find any disclosure in Yoda where heat treatment is performed after the deposition of one metal over the other metal. Therefore, we find that the examiner's rationale for rejecting these claims over Yoda because of the teaching of heat treatment in Yoda is not supported by the disclosure of Yoda. Therefore, we do not sustain the anticipation rejection of claims 41, 42, 49 through 51 and 52

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Rejections under 35 U.S.C. § 103

As a general proposition, in an appeal involving a rejection under 35 U.S.C. § 103, an Examiner is under a burden to make out a prima facie case of obviousness. If that burden is met, the burden of going forward then shifts to the applicant to overcome the prima facie case with argument and/or evidence. Obviousness, is then determined on the basis of the evidence as a whole and the relative persuasiveness of the arguments. See In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992); In re Hedges, 783 F.2d 1038, 1039, 228 USPQ 685, 686 (Fed. Cir. 1986); In re Piasecki, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984); and In re Rinehart, 531 F.2d 1048, 1052, 189 USPQ 143, 147 (CCPA 1976).

Lee and Wilson

In response to the examiner's rejection of claim 42 (answer at pages 5 and 6), over Lee and Wilson, appellants argue (brief at pages 8 through 11) that the combination of Lee and Wilson is improper. However, we need not reach the issue of the propriety



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examiner (answer at pages 5 and 13) that if the first metal is composed of pure aluminum or an aluminum alloy with no Cu component, and the second metal is composed of Al-Cu-Si (as disclosed in Lee), then obviously, the second metal containing Al-Cu-Si would have a higher concentration of Cu than the first metal of pure aluminum or a metal with no Cu. Therefore, Lee alone meets the recited limitation of a higher concentration of Cu in one metal relative to another metal. The addition of Wilson is merely cumulative to the rejection. Therefore, we sustain the obviousness rejection of claim 42 over Lee and Wilson.

Lee and Honeycutt

We enter a new ground of rejection, infra, of claim 43 due to the recited inconsistent requirements of "substantially continuous composition gradient . . . between said first metal and said second metal" (claim 41) and "wherein the first and second metals have substantially the same composition" (claim 43).

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is claimed and the prior art as we are obliged to do. Rejections under 35 U.S.C. § 103 should not be based upon "considerable speculation as to the meaning of the terms employed and assumptions as to the scope of the claims." In re Steele, 305 F.2d 859, 862, 134 USPQ 292, 295 (CCPA 1962). When no reasonably definite meaning can be ascribed to certain terms in a claim, the subject matter does not become obvious, but rather the claim becomes indefinite. In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). Accordingly, we are constrained to reverse, pro forma, the examiner's rejection of claim 43 under 35 U.S.C. § 103. We hasten to add that this is a procedural reversal rather than one based upon the merits of the section 103 rejections.

Regarding claim 44, even if the combination of Lee and Honeycutt were appropriate despite the protestations by appellants (brief at pages 11 to 13), we are of the view that the examiner has not made a prima facie case to meet the recited limitations. Specifically, Honeycutt does not teach that the

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Yoda and Honeycutt

With respect to the rejection of claims 43-45, and 57-60 over this combination (answer at pages 7 and 8), we reiterate our view regarding claim 43 and reverse its rejection pro forma. Regarding claims 44, 45 and 57 through 60, for the rationale given above under the anticipation rejection over Yoda, we are of the view that Honeycutt does not overcome the deficiency noted above in Yoda to meet the limitations of independent claim 41 upon which these claims depend. Therefore, the rejections of claims 44, 45 and 57 through 60 over Yoda and Honeycutt are not sustained.

Lee, Wilson and Honeycutt

In response to the obviousness rejection of claims 46 through 48, and 57 through 60 (answer at pages 8 and 9), appellants argue (brief at pages 14 and 15) that first, there is no motivation to combine Lee, Wilson and Honeycutt and secondly, even if the combination were proper, the combination still would not meet the claim limitations.

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on the contact surface of the silicone layer," and "a plug . . . being in contact at an end thereof with said metal silicide layer." Therefore, we do not sustain the obviousness rejection of claims 46 through 48, and 57 through 60 over Lee, Wilson and Honeycutt.

In conclusion, we have sustained the anticipation rejection of claims 41, 49 through 51, and 52 through 56 over Lee and the obviousness rejection of claim 42 over Lee and Wilson. However, we have not sustained the anticipation rejection of claims 41, 42, 49 through 51 and 52 through 56 over Yoda, nor the obviousness rejection of claims 43 and 44 over Lee and Honeycutt, of claims 43 through 45, and 57 through 60 over Yoda and Honeycutt, and of claims 46 through 48, and 57 through 60 over Lee, Wilson and Honeycutt.

New Rejection under 37 CFR § 1.196(b)

Claim 43 is rejected under 35 U.S.C. § 112, first paragraph for lack of enablement. Claim 43 is inconsistent with claim 41 in view of the disclosure at page 13, lines 19 through 21, where

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metallization layer 20 to a region of lower concentration in isolated contact plug 19. However, claim 43 requires that the first and second metals have substantially the same composition. Thus, there is no enablement in the disclosure where the two metals can have substantially the same composition and also have a substantially continuous composition gradient between a first metal and a second metal.

In addition to affirming the examiner's rejection of one or more claims, this decision contains a new ground of rejection pursuant to 37 CFR § 1.196(b). 37 CFR § 1.196(b) provides, A new ground of rejection shall not be considered final for purposes of judicial review.

Regarding any affirmed rejection, 37 CFR § 1.197(b) provides:

(b) Appellant may file a single request for rehearing within two months from the date of the original decision . . . .

37 CFR § 1.196(b) also provides that the appellant, WITHIN TWO MONTHS FROM THE DATE OF THE DECISION, must exercise one of

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rejection to avoid termination of proceedings (37 CFR § 1.197(c))  
as to the rejected claims:

(1) Submit an appropriate amendment of the claims so rejected or a showing of facts relating to the claims so rejected, or both, and have the matter reconsidered by the examiner, in which event the application will be remanded to the examiner. . . .

(2) Request that the application be reheard under § 1.197(b) by the Board of Patent Appeals and Interferences upon the same record. . . .

Should the appellant elect to prosecute further before the Primary Examiner pursuant to 37 CFR § 1.196(b)(1), in order to preserve the right to seek review under 35 U.S.C. §§ 141 or 145 with respect to the affirmed rejection, the effective date of the affirmance is deferred until conclusion of the prosecution before the examiner unless, as a mere incident to the limited prosecution, the affirmed rejection is overcome.

If the appellant elects prosecution before the examiner and this does not result in allowance of the application, abandonment or a second appeal, this case should be returned to the Board of Patent Appeals and Interferences for final action on the affirmed

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Accordingly, the decision of the examiner rejecting claims 41 through 60 is affirmed-in-part. We have also entered a new ground of rejection for claim 43.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a).

AFFIRMED-IN-PART  
37 CFR § 1.196(b)

ERROL A. KRASS	)	
Administrative Patent Judge	)	
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	)	BOARD OF PATENT
LEE E. BARRETT	)	APPEALS AND
Administrative Patent Judge	)	INTERFERENCES
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